

Sheldon E. Broedel, Jr., Ph.D.

Athena Environmental Sciences, Inc.
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Current Positions:

Chief Executive and Science Officer	Athena Environmental Sciences, Inc.
Advisor	Meyer Pharmaceuticals, Inc.
Deans Advisory Board, CNMS, UMBC	Founding Chair 2007-2009, Current Member, College of Natural and Mathematical Sciences, University of Maryland Baltimore County
Adjunct Professor	Department of Microbiology and Immunology, Georgetown University School of Medicine.
Adjunct Instructor, Graduate School	Department of Biological Sciences, University of Maryland Baltimore County
Science Advisory Board Member	Stevenson University, Baltimore, MD

Education:

Certificate	2000,	Biochemical Regulatory Engineering Program Concentration Track, University of Maryland, Baltimore County
Ph.D.	1990,	Microbial Genetics, University of Maryland, Baltimore County
M.S.	1984,	Microbial Genetics, University of Maryland, Baltimore County
B.S.	1979,	Biology, State University of New York at Geneseo

Research and/or Professional Experience:

1994 - Present	Chief Executive and Science Officer, Athena Environmental Sciences, Inc., Baltimore, MD. Co-founded Athena in 1994 and have served as the company's CEO/CSO since the company's inception. Responsible for overall executive management including directing the company's research projects, product development, business development and strategic planning activities. The company currently has product sales in over 20 countries.
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Key Accomplishments:

- Successfully, designed, developed and launched the company's 160+ products including (a) the Athena Enzyme Systems™ Protein Expression Services, which provides contract research and manufacturing services for biologics and biocatalyst development; (b) the Expression Media line of products, (c) the PDQ Protease Assay™ systems, (d) the Protein Refolding Kit product line and (e) the ACES™ Complete Protein Expression Systems (technology licensed from the University of Alberta).
- Lead the teams that designed and developed the production schemes for seven (7) biopharmaceuticals. One biologic drug is currently being produced in

	<p>support of pre-clinical development for human use and a second is being produced for animal use trials.</p> <ul style="list-style-type: none"> ➤ Established a 11 member international distribution network for the company's products by securing distribution agreements covering markets in Western Europe, Japan, North America, and Southeast Asia. ➤ Designed and managed the development of a biopolymer-based adhesive, MagigluTM. In 2009, secured a manufacturing agreement with Clementine Art, Bolder, CO to supply MagigluTM which is sold nationally under the Clementine Art brand in Whole Food Stores. ➤ Secured exclusive manufacturing agreements to produce the environmentally responsible products Plant Root Stimulator (Canadian Soilless) and The Bilge PillTM (Bilge Tech, Inc.) ➤ In 2002, negotiated, secured the funding for and managed the acquisition of the BRFF BrandTM of cell culture products by Athena from Biological Research Faculty and Facility, Inc. ➤ Authored three SBIR grants which received funding in 1998, 2003 and 2009.
2003 – Present	Meyer Pharmaceuticals, Inc. Has served as an advisor to Meyer Pharmaceuticals, Inc. (Irvine, CA) to assist with the clinical development of their new anti-inflammatory biopharmaceutical, MP8. Lead the team that designed and developed and currently produces the MP8 protein in support of pre-clinical development.
2007 – 2008	Applied Cell Sciences, Inc. Served as an advisory board member to assist the ACS with strategic planning until its merger with ChenTest, Inc.
1990 – 2001	Dorlin Pharmaceuticals, Inc., Baltimore, MD. (Formerly, Chektec, Corporation.) Co-founded the company's infectious disease program. Was awarded \$1.3 million in SBIR funding in support of research efforts to discover new antifungal drugs. Directed the research effort that led to the discovery of two patented antifungal agents as well as several unique targets and several discovery lead compounds. Positions held: <ul style="list-style-type: none"> 1996-2001 Vice President, R&D 1994-1996 Director, Therapeutic R&D 1991-1994 Group Leader, Diagnostic R&D 1991 Project Leader, R&D 1990-1991 Research Scientist
1992 - 1994	Science Advisor to Paragon Biotech, Inc., Baltimore, MD.
1985 - 1990	Doctoral Candidate, Department of Biological Sciences, University of Maryland Baltimore County.
1982 - 1985	Bioscience Department, Martin Marietta Laboratories, Baltimore, MD. <ul style="list-style-type: none"> 1984-1985 R&D Specialist 1982-1984 Assistant R&D Specialist
1979 - 1982	Masters Candidate, Department of Biological Sciences, University of Maryland Baltimore County.
1975 - 1979	Undergraduate, Department of Biology, State University of New York at Geneseo.

Products Developed: 160+ total

ACESTM Complete Expression Systems, a proprietary set of *E. coli*-based expression vectors designed for the secretion and export of recombinant proteins.

MagiGlue™, a water-reversible high performance general purpose glue and related products
 Athena Enzyme Systems™ Product Line: Augmedium™, LB*Booster™, Media Optimization Kit™,
 Hyper Broth™, Power Broth™, Superior Broth™, Turbo Broth™, Power Prime Broth™, Superior Prime
 Broth™, Turbo Prime Broth™, PowerEX Broth™, SuperiorEX Broth™, TurboEX Broth™, QuickFold™
 protein refolding kit, APF Certified™ culture media, I27O™, commercially available line of specialty
 culture media and recombinant protein recovery products marketed by AthenaES.

Bilge Pill™, commercially available, manufactured by AthenaES, marketed by Bilge Tech, Inc.

PDQ Protease Assay™, commercially available, marketed by AthenaES

OA-519™ Immunohistochemical Test, not currently being marketed

OA-519™ Immunometric Blood Test, not currently being marketed

Patents:

1. Weiner, et al. Protein Production Method Utilizing YebF. U.S. Patent Application No. 11/203,168.
2. Broedel, Jr., S. E. Reversible Biopolymer-based Adhesive. U.S. Patent application 60/736,057.
3. Harris, M. and Broedel, Jr., S. E. 2001. Bilge Cleaning Product. U. S. Patent #6,306,804.
4. Kruse, L. and Broedel, Jr., S. E. 1999. Antifungal Agents. U. S. Patent #5,859,027.
5. Broedel, Jr., S. E. and Kruse, L. 1999. Antifungal Agents for Agriculture. U. S. Patent #5,910,509.

Publications:

1. Kulla, J., R. Reich, and S. E. Broedel, Jr. 2009. Sterilizing combination products using oxides of nitrogen. MD&DI March 2009, pg. 46.
2. A. Albors, J. Cohen, R. Gandour, S. Hardric, J. Falkinham, III, S. Broedel, Jr., M. Cole, and R. Cihlar. Dendritic Amphiphiles Inhibit the Growth of *Candida* Species. ASM Conference on Candida and Candidiasis, Jersey City, NJ, March 24-26, 2008.
3. Broedel, Jr., S. E., E. Lange, J. Falkinham, R. Cihlar, M. Cole, and R. Gandour. Antimicrobial activity of dendritic dicarboxylate amphiphiles. ASM Biodefense and Emerging Infectious Disease Conference, Baltimore, MD, February 24-27, 2008.
4. Jodi A. Laakso, Robert Raulli, Gail E. McElhaney-Feser, Paul Actor, Ted L. Underiner, Brian J. Hotovec, Ursula Mocek, Ronald L. Cihlar, and Sheldon E. Broedel, Jr. 2003. CT2108A and B: New Fatty Acid Synthase Inhibitors as Antifungal Agents. J. Natural Products. J. Nat. Prod. 66(8):1041-1046.
5. Broedel, Jr., S. E. and Papciak, S. M. 2003. The case for serum-free medium. BioProcess International. 2:56-58.
6. Zhang, Z., ElSohly, H. N., Li, X.-C., Khan, S. I., Broedel, S. E., Jr., Raulli, R. E., Cihlar, R. L., Burandt, C. and Walker, L. A. 2003. Phenolic Compounds from *Nymphaea odorata*. J. Nat. Prod. 66(4): 548-550.
7. Zhang, Z., ElSohly, H. N., Li, X.-C., Khan, S. I., Broedel, S. E., Jr., Raulli, R. E., Cihlar, R. L., and Walker, L. A. 2003. Flavanone Glycosides from *Miconia trailii*. J. Nat. Prod. 66(1): 39-41.
8. Li, X.-C., Joshi, A. S., El-Sohly, H. N., Khan, S. I., Jacob, M. R., Zhang, Z., Khan, I. A., Ferreira, D., Walker, L. A., Broedel, S. E., Jr., Raulli, R. E., and Cihlar, R. L. 2002. Fatty Acid Synthase Inhibitors from Plants: Isolation, Structure Elucidation, and SAR Studies. J. Nat. Prod. 65(12), 1909-1914.
9. Cihlar, R. L., S. E. Broedel, Jr., and C. Kellogg. 2002. Antifungal drug targets: discovery and selection. In: Fungal Pathogenesis: Principles of Clinical Applications, R. L. Cihlar and R. A. Calderone, eds., Marcel Dekker, New York, NY.

10. Carrion-Vazquez M., A.F. Oberhauser, S.B. Fowler, P.E. Marszalek, S.E. Broedel, Jr. J. Clarke, and J.M. Fernandez. 1999. Mechanical and chemical unfolding of a single protein: a comparison. *Proc Natl Acad Sci U S A.* 96(7):3694-3699.
11. Zhao, X.- J., G.E. McElhaney-Feser, M.J. Sheridan, S.E. Broedel, Jr., R.L. Cihlar. 1997. Avirulence of *Candida albicans* FAS2 mutants in a mouse model of systemic candidiasis. *Infection and Immunity.* 65:829-832.
12. Egwim, K., R. Ellis, D. Raghavan, W.R. Jones, and S.E. Broedel, Jr. 1997 A novel fully integrated paint stripping and waste disposal system. Proceeding of the DoD Advanced Coating Conference.
13. Zhao, X.- J., G. E. McElhaney-Feser, W. H. Bowen, M. F. Cole, S. E. Broedel, Jr., and R. L. Cihlar. 1996. Requirement for the *Candida albicans* FAS2 gene for infection in a rat model of oropharyngeal candidiasis. *Microbiology* 142:2509-2514.
14. Broedel, Jr., S. E., X.- J. Zhao and R. L. Cihlar. 1996. Fatty acid synthase as a target in the development of new antifungals. *Recent Research Developments in Antimicrobial Agents and Chemotherapy.* 1:25-33.
15. Broedel, Jr., S. E., J. Lang, J. Tung, J. Kochen, and A. E. Alence. 1994. Characterization of tumor-derived fatty acid synthetase: a novel therapeutic target. *Proc. Am Assoc. Cancer Res.* 35:86.
16. Broedel, Jr., S. E. and R. E. Wolf, Jr.: Genetic tagging, cloning and DNA sequence of the *Synechococcus* sp. PCC 7942 gene (*gnd*) encoding 6-phosphogluconate dehydrogenase. *J. Bacteriol.* 172:4023-4031, 1990.
17. Broedel, Jr., S. E. and R. E. Wolf, Jr.: Regulation of the growth-phase-dependent expression of the gene encoding 6-phosphogluconate dehydrogenase of *Synechococcus* sp. PCC 7942. *Gene* 109:72-79, 1991.

Awards:

- 2005 Outstanding Alumni of the Year, University of Maryland Baltimore County, Catonsville, MD.
- 1979 Nick Hayes Managerial Award, S.U.N.Y. Geneseo Graduation Award, Geneseo, NY.
- 1973 Eagle Scout, Boy Scout Troop 7, Port Washington, NY.